Tiny Webservers

Link your own project to the Internet

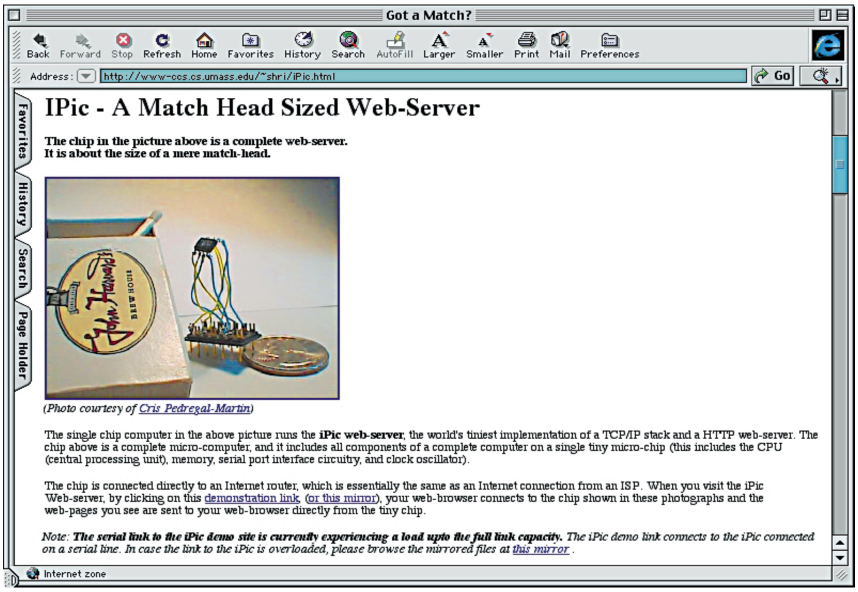
By G. Polder

E-mail, e-Commerce, and recently even e-Living, you mention it and it gets tied to the Internet. Lots of information is available on how to do that, as well as on the use of ever smaller webservers that come into play.

According to Scott McNealy, top executive of Java inventors Sun Microsystems, a car will soon be redefined as a virtual Java machine on wheels. According to Scott, it will not be long before household electronics not linked to the Internet will belong in a museum. After *e-commerce* and *e-business*, we now get *e-living*. The technology used by Sun for this purpose is called Jini, a network technology based on Java.

On *http://www.java.sun.com/jini* you may find lots of information on this promising technology. Many electronics manufacturers are busily working on Jini developments. Besides the Sun website, there is also an independent Jini site at *http://www.jini.org/.* The concept of Jini is very promising and although we are sure to see more of it in the near future, there is not a lot you can do with it as yet when it comes down to hands-on (hobby) electronics.

Fortunately that does not apply to the so-called *embedded web servers*. Although in principle Internet servers, these are stripped-down programs running on small processors like PICs. None the less, they do offer the basic functionality of Internet protocols like TCP/IP, allowing all manner of hardware to be coupled to the Internet. There are constant reports from different designers claiming to have designed to the smallest webserver. One the size of the head of a matchstick may be found at *http://www-css.cs.umass.edu/~shri/iPic.html* This server has been implemented on an 8-pin PIC type 12C509a. Denis Petrov on *http://www.chat.ru/~zhengxi/wwwpic/source.htm* shows a TCP/IP stack implementation and a www servers packed into a PIC16F84. The nice thing about this site is that the com-



IPic - A Match Head Sized Web-Server

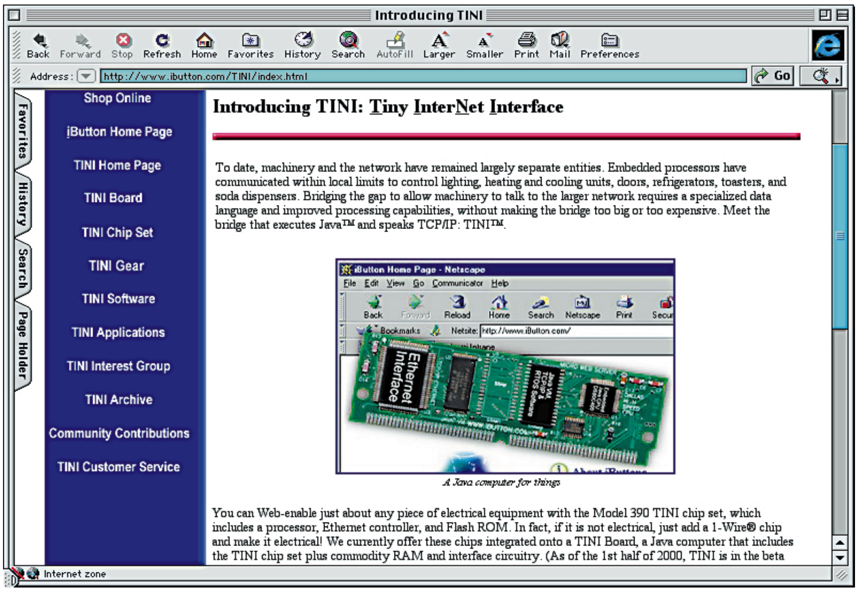
The chip in the picture above is a complete web-server.
It is about the size of a mere match-head.

(*Photo courtesy of Cris Pedregal-Martin*)

The single chip computer in the above picture runs the **iPic web-server**, the world's tiniest implementation of a TCP/IP stack and a HTTP web-server. The chip above is a complete micro-computer, and it includes all components of a complete computer on a single tiny micro-chip (this includes the CPU (central processing unit), memory, serial port interface circuitry, and clock oscillator).

The chip is connected directly to an Internet router, which is essentially the same as an Internet connection from an ISP. When you visit the iPic Web-server, by clicking on this demonstration link, (or this mirror), your web-browser connects to the chip shown in these photographs and the web-pages you see are sent to your web-browser directly from the tiny chip.

Note: ***The serial link to the iPic demo site is currently experiencing a load upto the full link capacity.*** *The iPic demo link connects to the iPic connected on a serial line. In case the link to the iPic is overloaded, please browse the mirrored files at this mirror .*

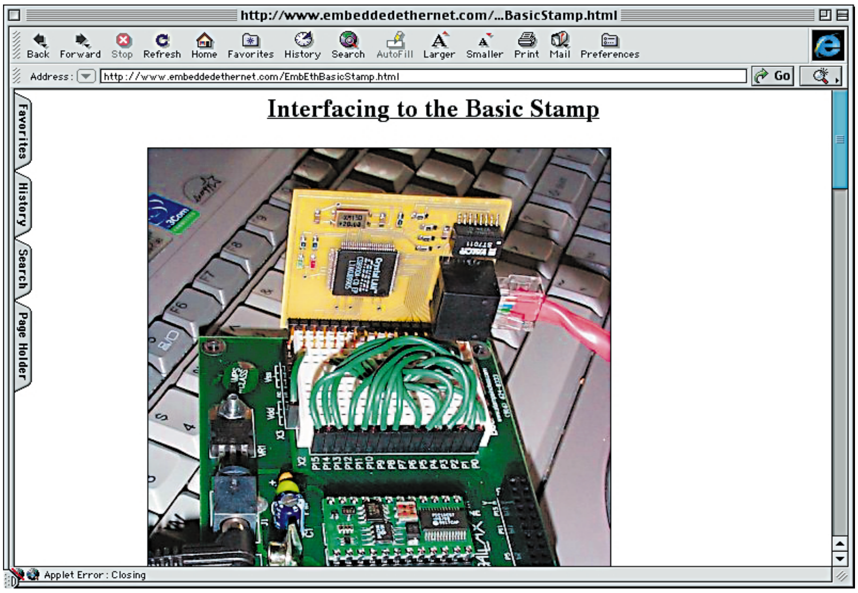


Introducing TINI: Tiny InterNet Interface

To date, machinery and the network have remained largely separate entities. Embedded processors have communicated within local limits to control lighting, heating and cooling units, doors, refrigerators, toasters, and soda dispensers. Bridging the gap to allow machinery to talk to the larger network requires a specialized data language and improved processing capabilities, without making the bridge too big or too expensive. Meet the bridge that executes Java™ and speaks TCP/IP: TINI™.

A Java computer for things

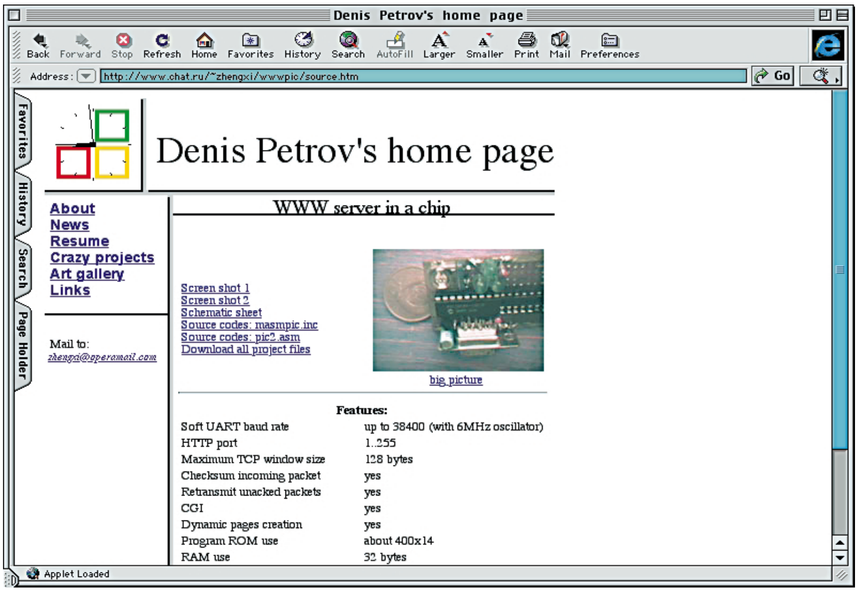
You can Web-enable just about any piece of electrical equipment with the Model 390 TINI chip set, which includes a processor, Ethernet controller, and Flash ROM. In fact, if it is not electrical, just add a 1-Wire® chip and make it electrical! We currently offer these chips integrated onto a TINI Board, a Java computer that includes the TINI chip set plus commodity RAM and interface circuitry. (As of the 1st half of 2000, TINI is in the beta



http://www.embeddedethernet.com/...BasicStamp.html

Address: http://www.embeddedethernet.com/EmbEthBasicStamp.html

Interfacing to the Basic Stamp



Denis Petrov's home page

Address: http://www.chat.ru/~zhengxi/wwwpic/source.htm

Denis Petrov's home page

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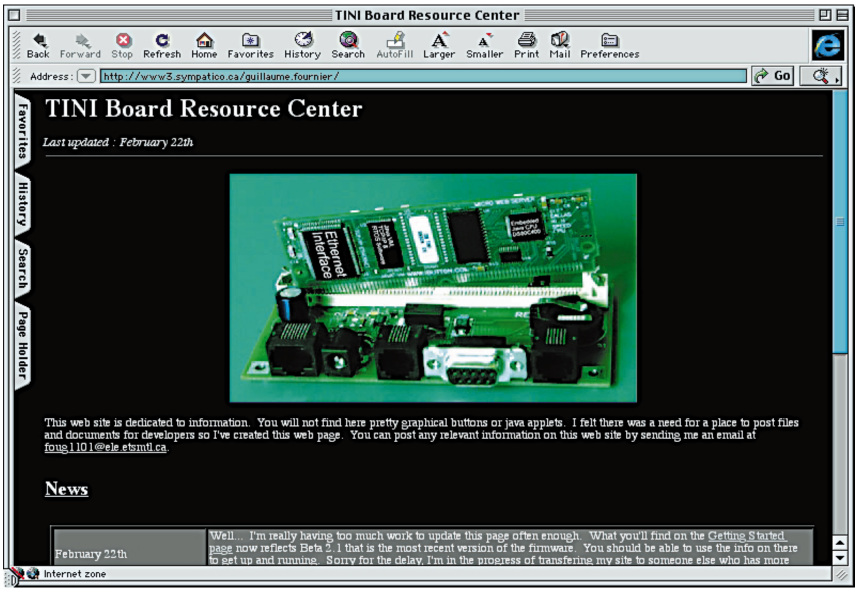
Mail to:
zhengxi@operamail.com

WWW server in a chip

Screen shot 1
Screen shot 2
Schematic sheet
Source codes: masmpic.inc
Source codes: pic2.asm
Download all project files

Features:

Soft UART baud rate	up to 38400 (with 6MHz oscillator)
HTTP port	1..255
Maximum TCP window size	128 bytes
Checksum incoming packet	yes
Retransmit unacked packets	yes
CGI	yes
Dynamic pages creation	yes
Program ROM use	about 400x14
RAM use	32 bytes



TINI Board Resource Center

Address: http://www3.sympatico.ca/guillaume.fournier/

TINI Board Resource Center

Last updated : February 22th

This web site is dedicated to information. You will not find here pretty graphical buttons or java applets. I felt there was a need for a place to post files and documents for developers so I've created this web page. You can post any relevant information on this web site by sending me an email at foug1101@ele.etsmtl.ca.

News

February 22th	Well... I'm really having too much work to update this page often enough. What you'll find on the Getting Started page now reflects Beta 2.1 that is the most recent version of the firmware. You should be able to use the info on there to get up and running. Sorry for the delay, I'm in the progress of transfering my site to someone else who has more

plete source code is available.

Microchip, the manufacturer of the PIC family, is also convinced of a great future for its processors.

On *http://www.microchip.com/internet/* you may find much relevant information. Other manufacturers are also active in this field. At *http://world.std.com/~fwhite/ace/* you may find a description of WebAce implemented on a Fairchild ACE1101MT8. Here, too, pictures of the chip and a matchstick.

More matchsticks, a box full actually, are found at *http://wearables.stanford.edu/* We saw a complete 486 processor no larger than a matchbox and running a Linux webserver.

In all of the above examples, the physical linking is via RS232. Using SLIP or PPP, TCP/IP is being implemented. As a matter of course, this solution is relatively slow and not very flexible. Because most companies these days employ Ethernet networks, it would be very convenient if embedded equipment would also be fitted with Ethernet connectivity. On *http://www.embeddedethernet.com* a small Ethernet controller is shown, complete with application examples for, among others, the BASIC Stamp.

Currently the nicest interface we feel may be found at

http://www.ibutton.com/TINI/index.html

The TINI (Tiny InterNet Interface) is a printed circuit board the size of a SIMM. It actually holds a processor running a virtual Java machine, together with a real-time operating system ad a TCP/IP stack. The interface with the real world comprises Ethernet, CAN, RS232, I^{2}C, 1-Wire and a number of digital inputs/outputs. TINI is currently in its beta phase and available for $50 if you want to experiment with it. Ultimately TINI will be packed into a single chip product and become available at a much lower price. Naturally, TINI has created a number of websites. At *http://www.systronix.com* a number of multi-purpose TINI interface boards may be found. The unofficial TINI Information Site at *http://www.smartc.com/tini/index.html* provides background information and user applications. Dallas Semiconductor maintains a website for bug reports and other developers' information on *http://tini.dalsemi.com/* Another website,

http://www3.sympatico.ca/guillaume.fournier also contains masses of information in Tini.

In conclusion we'd say that Scott McNealy's vision of the future may be closer than we think and that there are unprecedented possibilities for home constructors.

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